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ABSTRACT

The content of this paper is based on a development plan currently in design for the U.S. Navy in conjunction with the Learning Systems Institute at Florida State University. Leading research (literature review) references and case study ("best practice") references are presented as supporting evidence for the results-oriented distributed learning environment. The paper describes a conceptual model for a distributed learning environment, including linkages of performance requirements and appropriate learning theories and models. This conceptual model is embedded in a systems approach and reflects a learner-centered educational system. The emphasis is based on a results-oriented performance model for optimal required outcomes. The model is described in terms of a performance framework identified by both a needs assessment and needs analysis and comprised of four major subsystems (i.e., learner/performer support, course development, management, and learner/performer record), and the components of each subsystem, including key features and characteristics, functional requirements, and theoretical references. (Contains 21 references.) (Author/MES)

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Distributed Learning Environment

Major Functions, Implementation, and Continuous Improvement

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ABSTRACT

The content of the paper is based on a development plan currently in design for the U.S. Navy in conjunction with a renown learning institute at a major state university. Leading research references (literature review) and case study ("best practice") references as supporting evidence for the results-oriented distributed learning environment will be presented.

The paper describes a conceptual model for a distributed learning environment, including linkages of performance requirements and appropriate learning theories and models. This conceptual model is embedded in a system approach and reflects a learner-centered educational system. The emphasis will be based on a results-oriented performance model for optimal required outcomes. The model will be described in terms of a performance framework identified by both a needs assessment and needs analysis and comprised of four major subsystems, and the components of each subsystem, including key features and characteristics, functional requirements, and theoretical references.

DISTRIBUTED LEARNING

Kaufman (1995) describes distributed learning (distance learning) as the provision of valid and useful learning opportunities at a time and place convenient for the learner. At a basic level, distributed learning takes place when the learning facilitator and learner(s) are separated by physical distance. Technology (e.g., voice, video, graphics, and print) is used to bridge the separation. If identified as the most appropriate solution to a problem or opportunity, distributed learning programs can provide a wide range of learning opportunities. These programs can reach those disadvantaged by time limitations, distance, or physical disability, and update the knowledge base of workers at their places of employment (Willis, 1995). Distributed learning can often provide learning opportunities for those who could or would not otherwise avail themselves of further education or training.

SYSTEMS APPROACH

A systems approach assumes and strives for interdependence among supportive subsystems within a socio-cultural system. Key characteristics of a functional system include the transformation of the organization along the "information – knowledge – understanding" continuum. Indicators of expected outcomes serve as feedback within this continuously improving environment (Ackoff, 1974). This approach recognizes that a distributed learning environment (DLE) is composed of a number of interrelated processes within the subsystems that cannot be influenced independently. A DLE model should give emphasis to the concurrent design of these interrelationships (Branson, 1990).

To develop a DLE, four major subsystems should initially be considered (Donald P. Ely, personal correspondence, April, 1999):

1. Learner/Performer Support Subsystem.
2. Course Development Subsystem.
3. Management Subsystem.
4. Learner/Performer Record Subsystem.

In addition to these four major subsystems, the success of such a distributed learning environment is dependent on communication and data linkages that allow for a useful as well as an open and timely flow of information among all subsystems and with the learner and learning facilities. Continuous improvement of the DLE is contingent upon the collection of performance evaluation data for decision-making and valid and useful modifications to the system.

PERFORMANCE SYSTEM PLANNING

There is a practical method for identifying the expected impact of performance improvement solutions, distributed learning or otherwise. This method is Front-End Assessment and Alignment (FEAA)...often called "needs assessment" and is an integral part of strategic system planning (Kaufman, 1992, 1998).

By conducting a FEAA before investing resources in the preparation of specific courses in a distributed learning format, an organization will ensure that training and/or other performance interventions will provide useful results. Such results for a large, complex organization should include several linked levels of outcomes and payoffs, including on-the-job performance, organizational effectiveness, and societal impact. FEAA can benefit policy makers, course planners, and/or instructional designers by justifying their decisions in terms of the relative costs and value-added to involved stakeholders. In short, FEAA better ensures that the right solution or intervention (such as distributed learning, incentive systems, and performance support systems) is matched with the right performance problem, or the right opportunity.

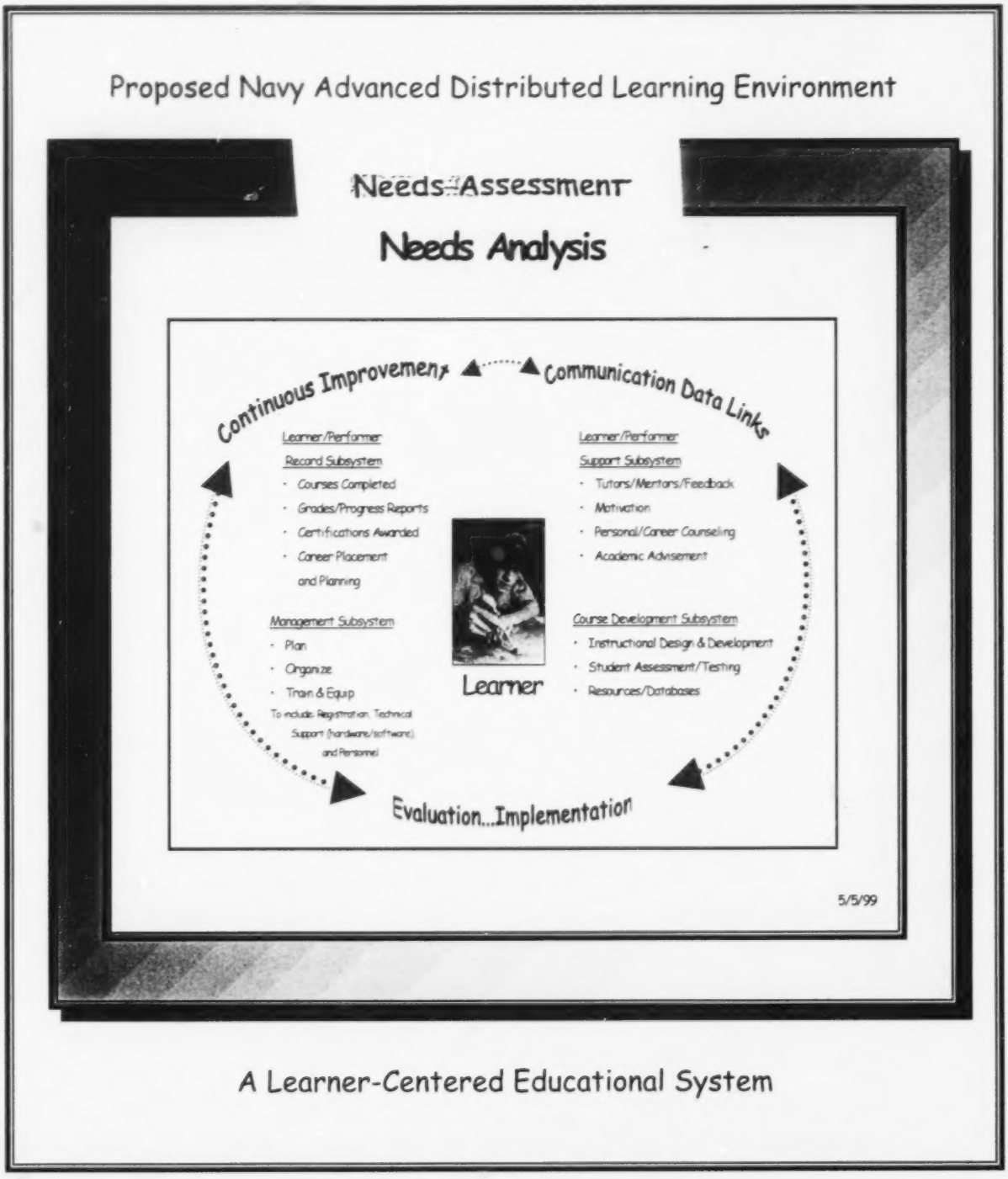
The FEAA facilitates the identification of:

1. "What Is" vs. "What Should Be" -- in terms of organizational results and requirements measures.
2. Possible solutions, including training, to meet these performance requirements.
3. Feasibility studies/prototypes indicating performance requirements that can/cannot be met using a specific solution or mix of solutions.
4. Evaluation criteria to drive continuous improvement.

It should be noted that the Distributed Learning Environment (DLE) lies within a larger organizational performance framework. Both a needs assessment and needs analysis that may provide useful data and information by integrating characteristics of the four major subsystems and indicators of overall organizational readiness identify elements of the framework. These two processes are embedded throughout the DLE and are applied as appropriate. Figure 1 illustrates an organizational performance framework, DLE, and its related elements.

Figure 1. The Proposed Navy Advanced Distributed Learning Environment.

US Navy Performance Framework



INTRODUCTION TO TABLES 1-6

In our research efforts to date, this framework has been used as the basis for an extensive review of successful distributed learning programs. From the review, "best practices" were identified for each subsystem component and its major sub-components. The following set of tables more fully explores each of the major functional subsystems in the DLE. The Course Development subsystem is further broken down into some of the major phases of learning systems design (e.g., needs assessment, analysis and planning, and instructional systems design). Each subsystem is reviewed relative to Components, Key Features and Characteristics, Functional Requirements, and Theoretical References or Evidence to support the information in the table. These tables are designed to show the linkages between best practices found in the literature for distributed learning programs and the elements of an effective Navy Advanced Distributed Learning Environment (NADLE). Note that Functional Requirements is focused on the hardware, software, and electronic means to make each component happen.

THE NEEDS ASSESSMENT ELEMENT OF SYSTEM PLANNING

The Needs Assessment (see Table 1) is the first step in improving decision-making and assuring that any intervention, including DL will meet the needs. Needs assessment is essential to useful planning because it assures that opportunities, purposes, and related solutions will be practical and results-oriented, not just process-oriented. It identifies and documents the gaps between current results and desired results, ideally those concerned with gaps in outcomes (fleet effectiveness and Navy valued added – or linked to them). The needs assessment arranges the gaps (needs) in order of priority and selects the needs to be resolved. Additionally, it provides criteria and other related information for continuous improvement. By correctly identifying real needs, before implementing any process or solution, organizations can improve their effectiveness and efficiency. The process can also help them reach ethical decisions by selecting the right job, so that doing the job correctly will be fruitful (Kaufman, 1992).

Table 1. US Navy Performance Framework: Needs Assessment.

Framework	**Component** ***What it is….***	**Key Features & Characteristics** ***What it does…***	**Functional System Requirements** ***How to make it happen…***	
Needs Assessment	Identification needs—gaps in results --of multi-level (i.e., Mega, Macro, and Micro), sets priorities, and provides cost-related criteria for the later selection of those for elimination or reduction.	Global/Fleet/Command/ Unit/Learner Levels • Identify gaps in results • Prioritize needs • Determine cost to close gap • Determine cost to ignore gap • Gather data • Create data tools (interview guides/ surveys/questionnaires /checklists)	Access to networked: • Assessment guides and tools • Manual/Guide (EPSS job aid) • On-line communication tools • Networked data collection tools • Word processing software • Database software • Presentation software	Access to stand-alone: • Assessment guides and tools • Manual/Guide (job aids) • Off-line communication tools • Stand-alone electronic or paper-based data collection tools • Word processing software • Database software • Presentation software
Theoretical References • Kaufman (1992, 1998) • Mager & Pipe (1997) • Rossett (1999)				

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THE NEEDS ANALYSIS ELEMENT OF SYSTEM PLANNING

The Needs Analysis (see Table 2) identifies the most effective and efficient ways and means to get the required results based on the causes for the needs. The needs analysis depends upon valid and prioritized needs and purposes which should have been previously identified during needs assessment. It then proceeds through various levels to determine all the requirements for successful problem resolution by identifying all aspects of the problem and setting detailed specifications for achieving organizational success. Each system analysis tool is results-oriented and identifies functions to be completed in order to meet needs. The tools may differ from others in degree, though not in kind, for they not only build on each other, but flow together.

Table 2. US Navy Performance Framework: Analysis and Planning.

Subsystem	**Component** *What it is....*	**Key Features & Characteristics** *What it does...*	**Functional System Requirements** *How to make it happen...*	
Needs Analysis	Identification and justification of functions required to meet needs and accomplish mission. It is based on the previously identified needs.	**Precursor to Solutions/Processes Level** • Define performance requirements and gaps based on the reasons the needs appear • Conduct analyses for the levels (if required) of: - Functions - Performance - Job task - Training/Instructional/Performance - Learner characteristics	Access to networked: • Analysis guides and tools (Same as above including COTS** analysis software) • Networked data collection tools - Word processing software - Database software - Presentation software **COTS = Commercial Off-the-Shelf	Access to stand-alone: • Analysis guides and tools (Same as above including COTS analysis software) • Stand-alone electronic or paper-based data collection tools - Word processing software - Database software - Presentation software

Theoretical References

- Brethower (1997)
- Clark & Estes (1998)
- Fuller (1997)
- Gilbert (1978)
- Harless (1987)
- Kaufman (1992,1998)
- Mager (1998)
- Robinson & Robinson (1994)
- Rossett (1999)
- Triner, Greenberry, & Watkins (1996)

THE LEARNER/PERFORMER SUPPORT SUBSYSTEM

The Learner/Performer Support Subsystem (see Table 3) supports ongoing learning and development of learners. Many distant learners require support and guidance to make the most of their distributive learning (distance learning) experiences (Threlkeld & Brzoska, 1994). This support typically takes the form of some combination of learner-instructor, learner-learner, and learner-knowledge/data source interactions. This subsystem may also include support centers where learners complete tests (ideally, valid criterion-referenced tests based on documented needs), meet with tutors and other learners, and interact with various knowledge/data sources.

Table 3. The Learner/Performer Support Subsystem.

Subsystem	**Component** ***What it is....***	**Key Features & Characteristics** ***What it does...***	**Functional System Requirements** ***How to make it happen...***	
Learner/ Performer Support Subsystem	• Tutors/Mentors/ Feedback • Motivation • Personal/Career Counseling • Academic/ Performance Advisement	• Provide performance/ instructional direction and/or support • Provide access to content expertise	Access to networked: • Resources & Communication Tools: - Library Systems - E-mail - WWW/Internet - Chat Rooms - Advisement Center Test Center	Access to stand-alone: • Resources & Communication Tools: - Library Systems - Phone/Fax - U.S. Mail - FedEx/UPS - Advisement Center Test Center
Theoretical References • British Open University • University of Phoenix • Lick (1998)				

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THE COURSE DEVELOPMENT SUBSYSTEM

The Course Development Subsystem (see Table 4) is composed of interdisciplinary teams involving instructional/performance subsystem designers, content-matter experts, tutors, evaluators, and editors. It supports the needs assessment, needs analysis, planning, design, development, implementation and evaluation, and the use of performance data--especially properly acquired needs assessment data--for continuous improvement for both the learner and the performance system(s). In addition to these functions, decisions regarding delivery system selection, performance support requirements, course or program maintenance must be made and appropriate processes put in place.

Table 4. The Course Development Subsystem: Instructional Design.

Subsystem	**Component** ***What it is....***	**Key Features & Characteristics** ***What it does...***	**Functional System Requirements** ***How to make it happen...***	
Course Development Subsystem	**Instructional Design** Application of systematic process for activating and supporting the learning process for the learner to meet performance requirements.(based on needs) • Interdisciplinary Design Teams. Members: - SMEs[1] - Educational Technologists - Media Specialists - Instructional Designers - Co-developers	**Curricula/Courses Level** • Collaborate to design & develop course objectives, instruction, and assessment • Access multi-media production services • Deliver a variety of instructional approach options: - Instructor-led classes - On-line training - Self-paced training - Computer-based - Team learning - Or a combination of any two or more of the above instructional approaches	Access to networked: • Instructional Planning guides and tools • Access COTS or create prototypes • Access to networked Resources & Communication Tools: - Library/Resource Systems - E-mail - WWW/Internet - Chat Rooms - Test Centers - Courseware training kits/materials - Study guides - Television and video options - Virtual bookstore - Free downloads - Access to networked Management & Learner Support Subsystems	Access to stand-alone: • Instructional Planning guides and tools • Access COTS or create prototypes • Access to stand-alone Resources & Communication Tools: - Library/Resource Systems - Phone/Fax - U.S. Mail/FedEx/UPS - Test Centers - Courseware training/ performance kits/materials - Study guides - Hardcover books - Television and video - Access to stand-alone Management & Learner Support Subsystems
Theoretical References • British Open University • FSU Learning Systems Institute • Microsoft Skills 2000 • Clark & Estes (1999) • Dick & Carey (1996) • Dills &Romiszowski (1997) • Ely (1990) • Gagne, Briggs, & Wager (1992) • Gustafson & Branch (1997)				

[1] Subject Matter Expert. Extreme care must be taken to assure that the data from the SMEs are valid, up-to-date, and relate to the actual task(s) that should be accomplished.

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THE MANAGEMENT SUBSYSTEM

The Management Subsystem (see Table 5) is responsible for planning, organizing, and operating the learner-centered NADLE. An important function of this subsystem is to assure that valid and needs-related performance data/feedback are used to make modifications as required. At a more detailed level, this subsystem should address the issues of: learner registration, production and delivery, technical support (hardware and software), staff selection, training/development, and payroll/rewards, as well as the logistics behind ensuring deadlines are met and budgets balanced. Another aspect of this subsystem is the assurance that learning opportunities, learning vehicles, and learning materials are available, valid, and useful.

Table 5. The Management Subsystem.

Subsystem	Component *What it is….*	Key Features & Characteristics *What it does…*	Functional System Requirements *How to make it happen…*	
Management Subsystem	• A Plan: Strategies and tactics • Organization: Infrastructure • Supervision: Selection and training • Direction: Responsibility & Authority • Coordination: Logistics • Operation: Implementation, marketing and public relations • Research & Evaluation: Internal process for decision-making • Budget: Fiscal planning • Solicitation of useful feedback • Program Maintenance • Revision: Continuous improvement	• Identify needs and their derived performance requirements • Establish objectives • Develop plans • Establish schedules • Implement plans • Measure progress • Make decisions/reactions • Update contents • Revise as required The above especially address: - Registration - Technical Support (hardware/software) - Personnel - Production & Delivery	Access to networked: • Management guides and tools • Access to networked Resources & Communication Tools: - Library Systems - E-mail - WWW/Internet • Networked data collection tools - Word processing software - Database software - Presentation software - Access COTS or create prototypes	Access to stand-alone: • Management guides and tools • Access to stand-alone Resources & Communication Tools: - Library Systems - Phone/Fax - U.S. Mail - FedEx/UPS • Stand-alone electronic or paper-based data collection tools - Word processing software - Database software - Presentation software - Access COTS or create prototypes
Theoretical References • British Open University • Microsoft Skills 2000 • University of Phoenix • University of South Carolina, College of Library and Information Science • Ely, (1990) • Fuller (1997) • Greer (1992) • Kaufman (1992, 1998) • Scriven (1997)				

THE LEARNER/PERFORMER RECORD SUBSYSTEM

The Learner/Performer Record Subsystem (see Table 6) tracks the activities of NADLE learners. It provides activity/accomplishment profiles for learners including, but not limited to, such data as courses attempted, courses completed grades and performance assessments, progress reports, and certifications awarded. Because individual performance is but one element in a successful system (Triner, Greenberry, & Watkins, 1996), payoffs for mastered performance abilities should also be tracked through the unit, fleet, and external value-added levels. This subsystem is critical in enabling learners to begin taking responsibility for their own learning. It helps learners gain an overview of what they have and have not completed and can guide their future development. The performance data collected in the subsystem will be useful for the continuous improvement of all other subsystems as well.

Table 6. The Learner/Performer Record Subsystem.

Subsystem	Component *What it is….*	Key Features & Characteristics *What it does…*	Functional System Requirements *How to make it happen…*	
Learner/ Performer Record Subsystem	Information databases for: • Courses Completed • Grades/Progress Reports • Certifications Awarded • Career Placement/Planning	• Document learner/performer activity (i.e., track, monitor, and assess) • Develop career plan (i.e., personal planning profile) • Create certificates/awards	Access to networked: • Records management guides and tools • Access to networked Resources & Communication tools: - Library Systems - E-mail - WWW/Internet • Networked data collection tools - Word processing software - Database software - Presentation software - Access COTS or create prototypes	Access to stand-alone: • Records management guides and tools • Access to stand-alone Resources & Communication tools: - Library Systems - Phone/Fax - U.S. Mail/FedEx/UPS • Stand-alone electronic or paper-based data collection tools - Word processing software - Database software - Presentation software - Access COTS or create prototypes
Theoretical References • British Open University • Microsoft Skills 2000 • University of Phoenix • University of South Carolina, College of Library and Information Science • Moore & Kearsley (1996) • Willis (1995)				

ILLUSTRATION OF AN OPERATIONAL DISTRIBUTED LEARNING ENVIRONMENT

The following example illustrates the operation of the Distributed Learning Environment, which may be applied to any organizational setting.

Situation

Big Software Maker of America has numerous offices and production facilities across the world. Much of their training and development activity is generated in the corporate office and offered to employees exclusively at regional training centers using live instructors as their primary delivery vehicle. The organization is considering how they can distribute this learning to more employees in a systematic way, allowing more flexibility in training, assessment, and certification location without greatly disrupting ongoing work structure and schedules. In addition, they are concerned with the high cost of travel associated with training.

Possible solution...

Lets suppose, for instance, that a thorough needs assessment has identified a training program for first time managers, which we will call *First Level Management Training Program,* as a solution. The management subsystem would register all those employees eligible and available for the First Level Management Training Program, for instance.

This program is then systematically designed and developed by the course development subsystem. Following an instructional design model, they select CD-ROM as the primary delivery method, using the WWW as a supporting learning tool where they may access references and other additional course information. Trainees have the option of going through training at their present locations, be it office, home, or on the road, without having to travel to a regional training center, in turn reducing training cost to the organization. Should the trainees have any questions or difficulties, each has access to a tutor via telephone, email or in person at one of the local support centers if this is convenient to them.

The student record subsystem, meanwhile, would keep track of which employees are going through this training program at any given time as well as other training programs and/or courses they have previously completed. Consequently, trainees have access to progress reports and other information relating to their career development. All this data is of course shared through a common database accessible by all the subsystems.

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IMPLEMENTATION/DIFFUSION

This document should be used as a starting point for making decisions about the implementation of a DLE. It serves as a guide for selecting components to be included in a conceptualization of the possible components in this learning environment. It should be used along with organizational performance data to plan revisions to the operating environment and its respective subsystems. The use of front-end assessment and analysis would likely provide the designer/developer with information regarding relative effects, problems, and benefits within the whole system. The use of the FEAA process will require additional time from the developers. However, this is time well spent, as it will offer pre-implementation insight as to the value-added for the accomplishment of organizational performance, training and education goals.

The concurrent design process would include appropriate selection of technical support tools that will facilitate the necessary communication and data linkages. In addition, the selection of media (e.g., hardware, software, video, audio, and print) that function independently and interdependently with the DLE subsystems will be addressed. These data linkages will be designed and developed to support the evaluation, continuous improvement, and quality of the DLE.

The final system requirements and design specifications will be determined by organizational learners, instructors and course developers who identify what is working and what is not. Feedback data from rapid prototype designs will be used to make revisions and continuously improve the delivery of all training and education within the organization.

Although the effectiveness of technology in different distributed education applications and settings is currently under much research scrutiny, further study of the practical, social, and cultural implications of the use of technology in education/training is required (Bechky, 1999). The methods suggested in this paper should provide insight into the context and process of learning and could help shape distributed education/training programs in the future.

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